O.W.R.C.
~~Water Pollution~~
~~Survey~~

THE
ONTARIO WATER RESOURCES
COMMISSION

WATER POLLUTION SURVEY

of the

VILLAGE OF DELORO

COUNTY OF HASTINGS

1971

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ONTARIO WATER RESOURCES

COMMISSION

Report on a

Water Pollution Survey

of the

VILLAGE OF DELORO

in the

COUNTY OF HASTINGS

Division of Sanitary Engineering

District Engineers Branch

1971

Water Pollution Survey

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REPORT ON A

WATER POLLUTION SURVEY

OF THE

VILLAGE OF DELORO

INTRODUCTION

A pollution survey in the Village of Deloro was performed by Commission staff on June 3, 1970. Surveys of this type are conducted by the Division of Sanitary Engineering, Ontario Water Resources Commission, to review and evaluate the efficiency of the waste treatment systems.

This report recommends procedures necessary to ensure that sources of surface water pollution are eliminated and the objectives of the Ontario Water Resources Commission are met.

At the time of the survey discussions were held with the following:

Mr. A. Clemens, Councillor

Mrs. B.M. Young, Clerk

Mr. C. Gordanier, Reeve, was also contacted several times after the survey.

BRIEF HISTORY & DESCRIPTION

The Village of Deloro is located approximately one-half a mile north of Highway No. 7 between the Villages of Madoc and Marmora.

Although the Deloro Smelting and Refining Company Limited closed in 1961, it was not until 1968 that most of the land was turned over to the municipality to comprise the present limits of the incorporated village.

The people living within the Village of Deloro limits are comprised mostly of retired farmers, elderly people at the nursing homes, and families who rely on income from Marmoraton Mining Company Limited. It is unlikely that new job opportunities, such as from new industry locating in the area, will be available in the very near future.

Drainage for the area is provided by the Moira River which runs through the easterly section of the village.

GENERAL SOIL CONDITIONS AND TOPOGRAPHY

The land within the village boundaries is undulating with highest level about 700 feet above sea level. In the built up area it is about 50 feet lower with a gradual sloping towards the Moira River.

The soil structure consists in general of very stony materials derived from red and grey calcareous shale. These soils are well drained. Outcropping of Precambrian rocks is also very predominant.

POPULATION

The present population as quoted in the 1970 Municipal Directory is 251. This figure represents an increase of 58 people or 38 per cent from the previous year. Converting a former school to a nursing home has contributed to the above normal population increase. The two nursing homes have a combined population of approximately 35 people.

EXISTING WATER TREATMENT FACILITIES

Water obtained from a 70-foot drilled well is afforded chlorination treatment before being pumped to the distribution

system. Samples collected by Commission staff in the past have indicated that generally the water is chemically satisfactory. The red and grey layered shale has a fairly high content of magnesium carbonate, no doubt contributing to the fact that the water is classified as "very hard".

EXISTING SEWAGE TREATMENT FACILITIES

Introduction

All domestic waste is conveyed to the municipal underdrain tile bed system by approximately 1,200 feet of gravity sewers running the length of the main street. Service connections to the sewer total 44 with the remaining homes being served with septic tank systems.

Effluent waste from the sedimentation tank is discharged to a disposal bed consisting of 1,920 linear feet of 4-inch diameter tile, i.e., 32 rows x 60 feet (4 feet apart). The underdrain bed also consists of 4-inch diameter tile, laid 2 feet below the distribution tile. The underdrains are then connected to an outlet which discharges to a swampy area adjacent to the Moira River. As expected, the drainage eventually makes its way to the river.

Originally, it was reported the sedimentation tank had a capacity of 7,500 gallons and the siphon chamber of 750 gallons. However, when the tanks were being pumped out in July 1970, Mr. Gordanier measured the tank dimensions and found the above to be incorrect. Apparently, the capacity of the sedimentation tank is closer to 14,000 gallons.

Sewage Flows

To establish some cognizance of the daily flows, gauging was conducted at two locations on June 3, 1970. A V-notch weir installed in the sewer at the last manhole prior to the sedimentation tank enabled staff to estimate the instantaneous flow at 18,000 imperial gallons per day.

The second location selected was between the sedimentation tank and siphon chamber. By determining the length of time to fill a measured container, the flow was estimated to be 22,000 imperial gallons per day.

Since the flows were measured at 1:00 P.M. of June 3, 1970, when the average daytime flows would be encountered, consideration had to be given to the total day. Therefore, based on the above figures, the average daily flow was estimated to be 15,000 imperial gallons.

Using an average per capita flow of 60 gallons per day for the people connected to the system, the normal sewage flow should be in the range of 12,000 gallons. As pointed out by village officials and substantiated by the measured flows, the intrusion of ground water is quite evident. In many areas, the sewer is constructed below the ground water table, the understandable reason for the infiltration.

Results of Hydraulic Loadings

In the "Manual of Septic Tank Practices" published by the United States Department of Health the following design parameters are recommended for underdtain tile bed systems:

Retention Period for Sedimentation Tank . . . . 24 hrs.

Hydraulic Loading of Filter Beds . . . . 1 gallon/ft^2/day

The required retention period in the sedimentation tank would be achieved with a normal average daily flow of 15,000 gallons. Unfortunately the same conditions do not apply concerning the hydraulic loading on the filter bed as shown below:

Average Daily Flow . . . . 15,000 imperial gallons

Filter Bed . . . . 7,680 square feet

Average Daily Hydraulic Loading on Filter

$\frac{15,000}{7,680}$ = 1.95 imperial gallons per square foot per day

Staff in the past have expressed concern that filtration to the underdrain tile from the disposal bed was not occurring and instead flowing directly to the discharge pipe. A visual observation of the outlet revealed the presence of solid wastes indicating that this phenomena was indeed occurring. This action is a direct consequence of the hydraulic loading on the system.

The construction of a larger tile bed system is improbable in view of the enormous amount of fill required. In other words, conditions must be altered prior to the tile system to relieve the hydraulic overloading.

RESULTS OF SAMPLES

At the time of the survey a total of five samples were collected. They included:

a) Chemical sample at last manhole on distribution system prior to treatment (raw sewage).

b) Bacteriological and chemical sample of effluent from underdrain tile bed system (treated waste).

c) Bacteriological and chemical sample from drainage course between treatment system and Moira River.

All samples arrived at the Ontario Water Resources Laboratory within 8 hours of collection. Generally, the analysis techniques used in the study were those specified in "Standard Methods". A complete summary of the results is given in Appendix One.

Although twelve parameters were involved in the analyses, only the major ones will be elaborated on to keep the discussion from becoming too confused and overlapping.

The 5-day B.O.D. values noted in the raw sewage also confirmed the fact that water was infiltrating into the sewer. Although the 5-day B.O.D. concentration of the treated waste was slightly less than the raw sewage, the very low organic loadings and type of treatment make it difficult to fully assess the efficiency of the underdrain tile bed. Aquatic weed growth, bullrushes, etc., acted as a further refinement to the system as 5-day B.O.D. values in the sample collected at Sampling Point No. 3 were only 1.6 p.p.m.

Similar results were obtained for the suspended solids.

Total phosphorus and nitrogen concentrations were also below that normally encountered for raw sewage. It was interesting to note the uptake of nutrients by the underbush as evidenced by the values noticed at Sampling Point No. 3. In addition, most of the nitrogen had stabilized in the form of nitrate.

Bacteriologically, the effluent as measured at the discharge from the underdrain tile bed system and Sampling Point No 3

was unsatisfactory. Elimination of the potentially harmful bacteria which is a necessity can be accomplished by installing a small hypochlorinator at the discharge line from the filter bed.

OPERATION OF UNDERDRAIN TILE BED

The operation of the underdrain tile bed system has in the past been minimal. If a certified level of plant performance is to be achieved, conscientious operational attention is essential. Therefore, it is recommended that checks be made of the system periodically to ensure (a) no blockages occur especially between the sedimentation tank and siphon, (b) the build-up of oil and scum is removed regularly, (c) tanks are pumped out at least once every two years. Apart from the above, normal operation and correction of all troubles is desired.

PROPOSED DEVELOPMENT

At the present time, nine lots on the main street are being developed. Since the development is north of the services, individual septic tanks and wells will be utilized.

No definite plans have been made to develop any of the other 74 registered lots within the municipality. In view of the present hydraulic overloading of the underdrain tile bed system coupled with the sporadic water capacity problems in the summer, extension of the services is not recommended. It is understood that council have already adopted this policy.

A few parcels of land, namely in the area of the underdrain tile bed, the water works and municipal dump, are considered undesirable for development.

SUMMARY

With hydraulic flows exceeding the design capacity of the filter bed, a high degree of treatment is not expected. Treated waste does, however, receive further refinement as it trickles through a swamp approximately 400 feet from the filter tile bed. Considering that the swamp is well isolated and separated from the village, the detrimental effects of the underdrain tile bed system are minimal. Some effort, however, should be made to disinfect the effluent.

The OWRC recognizes the financial state of the municipality and the expenditures needed to improve the waste stabilization system. By exposing these to you, it is hoped that budgeting for the required expenditures will be considered now. Correction of the system is not an insuperable problem.

RECOMMENDATIONS

1. Consideration should be given to chlorinating the treated effluent.
2. To minimize major expenditures, constant vigilance and operation of the treated works is recommended.
3. Further connections of the municipal services are not recommended in view of the hydraulic overloading of the underdrain tile bed system and the sporadic capacity problems.

RAD/dek

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Division of Sanitary Engineering.

APPENDIX ONE

VILLAGE OF DELORO

POLLUTION SURVEY - 1970

Date of Sample	Sample Point Number	Location of Sample Point	5-Day BOD	Solids Tot	Solids Susp	Nitrogen as N: Free Ammonia	Nitrogen as N: Total Kjeldahl	Nitrogen as N: Nitrite	Nitrogen as N: Nitrate	Phosphorus as P: Tot	Phosphorus as P: Sol	Total Coliforms per 100 ml.	Fecal Coliforms per 100 ml.
June 3	1	Last manhole on distribution system. (Raw Sewage)	38	420	20	3.5	5.5	.014	<.01	1.5	0.30	-	-
June 3	2	Effluent from underdrain tile bed. (Treated Sewage)	32	290	35	7.5	9.5	.080	.34	1.9	0.90	1,890,000	570,000
June 3	3	At Railroad and drainage course from treatment system.	1.6	390	5	0.50	0.56	.040	4.0	1.3	1.00	>15,000	>1,500

APPENDIX TWO

WATER QUALITY AND EFFLUENT OBJECTIVES

The OWRC objectives for surface waters is described in a booklet entitled "Guidelines and Criteria for Water Quality Management in Ontario". A copy of the booklet is enclosed in the pocket on the back cover of this report. This publication contains the guidelines and introduces water quality criteria for various uses including public, agricultural and industrial water supply, recreation, aesthetic enjoyment and the propagation of fish and wildlife. The guidelines should be followed to determine the acceptability of a watercourse for various uses.

A few pertinent maximum limits of contaminants in sewage treatment plant and industrial effluents are listed below. Adequate protection for surface waters except in certain specific instances influenced by local conditions, should be provided if the following concentrations and pH range are not exceeded.

5-Day BOD - not greater than 15 ppm
Suspended Solids - not greater than 15 ppm
Phenols - not greater than 20 ppb
pH - 5.5 to 10.6
Iron - not greater than 17 ppm
Ether solubles (Oil) - not greater than 15 ppm

GLOSSARY OF TERMS

Bacteriological Examinations - The Membrane Filter Technique is used to obtain a direct count of coliform organisms. These or-

ganisms are the normal inhabitants of the intestines of man and other warm-blooded animals and soils. They are always present in large numbers in untreated sewage and are, in general, relatively few in number in other stream pollutants. The fecal portion of the total coliforms originate only in the intestines of man and warm blooded animals and indicate recent pollution.

Sanitary Chemical Analyses

Biochemical Oxygen Demand (BOD)

Biochemical Oxygen Demand is reported in parts per million (ppm) and is an indication of the amount of oxygen required for the stabilization of the decomposable organic or chemical matter in the water. The completion of the laboratory test requires five days, under the controlled incubation temperature of 20^{o} Centigrade.

Solids

The value for solids, expressed in parts per million (ppm) is the sum of the values for the suspended and the dissolved matter in the water. The concentration of suspended solids is generally the most significant of the solids analyses with regard to surface water quality.

The effects of suspended solids in water are reflected in difficulties associated with water purification, depositions in streams and injury to the habitat of fish.

Nitrogen

Ammonia Nitrogen (Free Ammonia) is the soluble product in the decomposition of nitrogenous organic matter, it is also formed when nitrates and nitrites are reduced to ammonia either biologically or chemically. Some small amount of ammonia, too, may be swept out of the atmosphere by rain water.

The following values may be of general significance in appriasing free ammonia content: Low 0.015 to 0.03; Moderate 0.03 to 0.10 ppm; High 0.10 or greater.

Total Kjeldahl is a measure of the total nitrogenous matter present except that measured as nitrite and nitrate nitrogens. The Total Kjeldahl less the Ammonia gives a measure of the organic nitrogen present. Ammonia and organic nitrogen determinations are important in determining the availability of nitrogen for biological utilization. The normal range for Total Kjeldahl would be 0.1 to 0.5 ppm.

Nitrite Nitrogen

Nitrite is usually an intermediate oxidation product of ammonia. The significance of nitrites, therefore, varies with their amount, source and relation to other consitituents of the sample, notably the relative magnitude of ammonia and nitrate present. Since nitrite is rapidly and easily converted to nitrate, its presence in concentrations greater than a few thousandths of a part per million is generally indicative of active biological processes in water.

Nitrate Nitrogen

Nitrate is the end product of aerobic decomposition of nitrogenous matter, and its presence carries this significance. Nitrate concentration is of particular interest in relation to the other forms of nitrogen that may be present in the sample. Nitrates occur in the crust of the earth in many places and are a source of its fertility.

The following ranges in concentration may be used as a guide. Low, has less than 0.1 ppm; Moderate, 0.1 to 1.0 ppm; High, greater than 1.0 ppm.

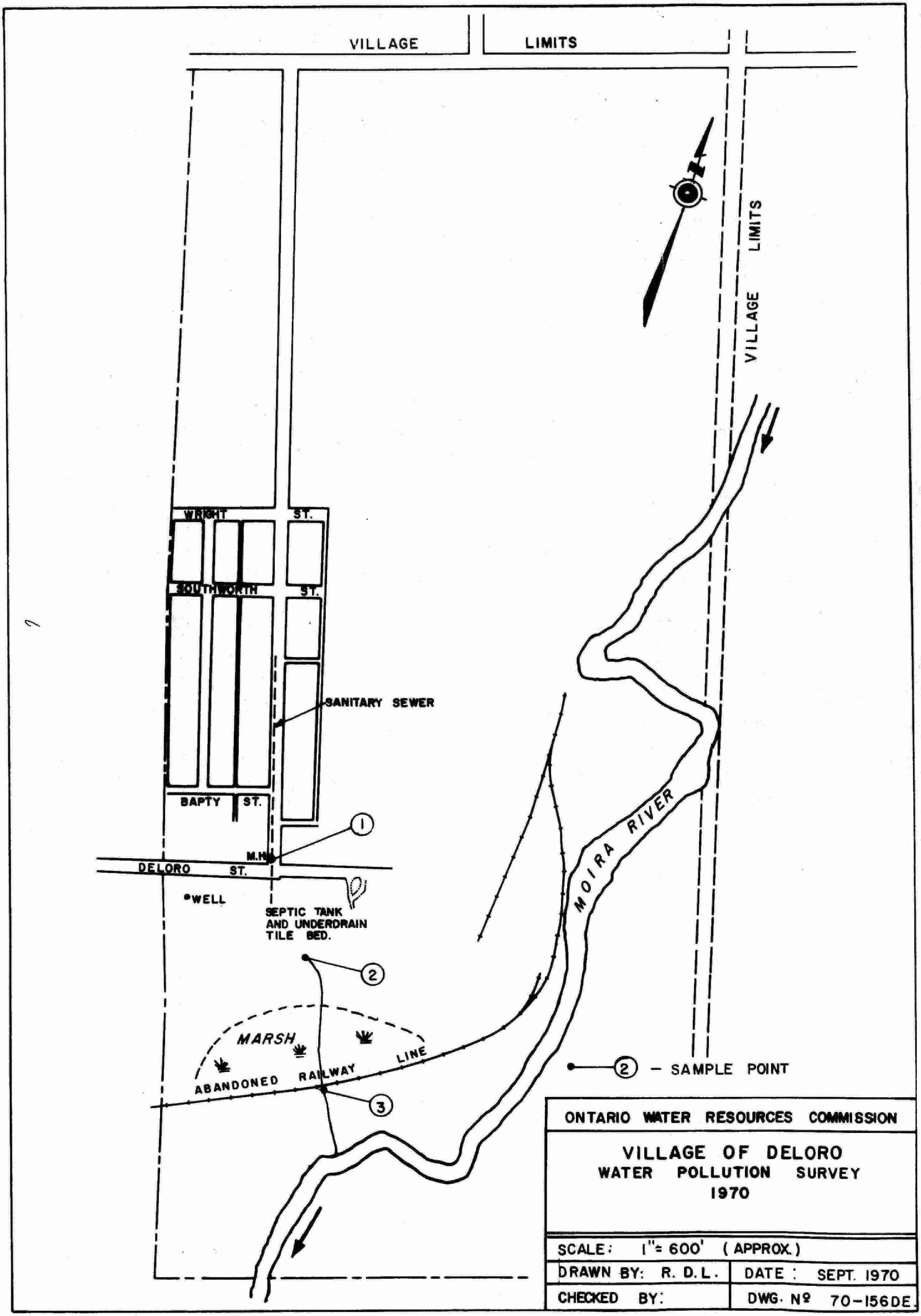
Phosphorus

Total Phosphorus

Total Phosphorus is a measure of both the organic and inorganic forms of phosphorus present.

Soluble Phosphorus

Soluble Phosphorus is a measure of the orthophosphate only and when subtracted from the total phosphorus gives an indication of the concentration of organic phosphorus present. That is, the soluble phosphorus is a measure of the inorganic phosphorus present except the phosphorus in the form of polyphosphate, which however, in surface waters is usually insignificant. Inorganic phosphorus in concentration in excess of 0.1 ppm may cause nuisance conditions.


VILLAGE LIMITS
VILLAGE LIMITS
WRIGHT ST.
SOUTHWORTH ST.
SANITARY SEWER
BAPTY ST.
M.H.
DELORO ST.
WELL
SEPTIC TANK AND UNDERDRAIN TILE BED.
MOIRA RIVER
MARSH
ABANDONED RAILWAY LINE
1
2
3
2 - SAMPLE POINT
ONTARIO WATER RESOURCES COMMISSION
VILLAGE OF DELORO
WATER POLLUTION SURVEY
1970
SCALE: 1" = 600' (APPROX.)
DRAWN BY: R. D. L.
DATE: SEPT. 1970
CHECKED BY:
DWG. Nº 70-156DE.